Evaluation and Development of Poa *Germplasm for Salt Tolerance*

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Objectives:

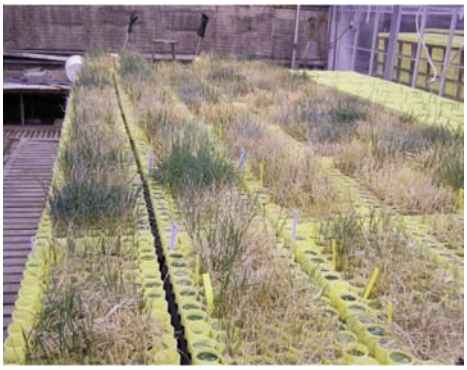
1. To identify salt-tolerant *Poa* germplasm that can be incorporated into breeding and genetics efforts.
2. To identify genes whose RNA transcript levels vary between control and high salinity treatments.

Start Date: 2007
Project Duration: three years
Total Funding: $75,237

It is widely known that one of the greatest challenges confronting the turf industry today is water. Golf course superintendents and other landscape managers are being asked to use less irrigation water, use lower quality water sources, and allow more use of the turfgrass areas. Turfgrass with high turfgrass quality and greater salt tolerance is essential.

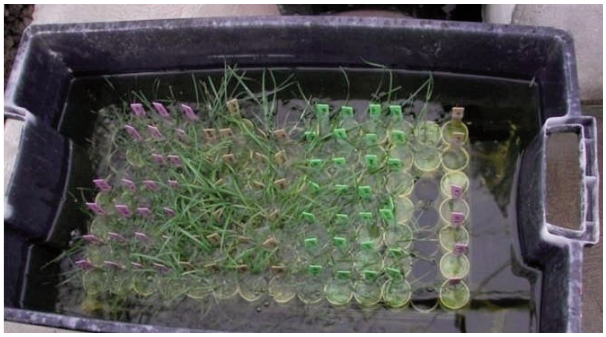
Beginning in 2005, the USDA-ARS Forage and Range Research Lab (FRRL) in Logan, Utah and Utah State University started work in the area of salt and drought tolerance evaluation in *Poa*. A cooperative agreement has also been established with Utah State University. As part of this cooperative effort, we are evaluating a large number of National Plant Germplasm accessions, collections from around the world, somaclonal lines of *P. pratensis* from Dr. Nancy Ehlke at the Universityof Minnesota, and numerous currently available varieties.

These lines are being evaluated in field conditions for turf and seed production characteristics, drought tolerance, and other traits and will be used to combine stress tolerance and turf quality traits in germplasm that can be used by the seed industry.



Seedings were grown in sand and when at the 3-tiller stage, were subjected to increasing salt concentrations (increased by 3.0 dS m-1 increments every 2 weeks) and evaluated until plant death.

Many *Poa* species, and most of the available germplasm within *Poa pratensis*, has not been rigorously evaluated for salt tolerance and turf characteristics in the arid West climate. Similarly, there is not a good understanding of the genetic control of salt tolerance in *Poa*. We are expanding a breeding and genetics program to develop improved salt-tolerant bluegrass (*Poa*) germplasm.



Poa germplasm was emersed in increasingly saline water and evaluated in the greenhouse for salinity tolerance.

Using our large and growing collection of germplasm from a variety of sources, we have and will continue to conduct a rigorous program of screening for salt tolerance and will identify candidate genes associated with salt tolerance in *Poa* using suppressive-subtractive hybridization methods.

We completed an initial evaluation of salinity tolerance of *Poa* germplasm with a proven method developed at the FRRL. In a greenhouse, seedings were grown in sand and when at the 3-tiller stage, were subjected to increasing salt concentrations (increased by 3.0 dS m^{-1} increments every 2 weeks) and evaluated until plant death.

Based on two runs of the experiment, several germplasm sources were identified with consistently high salinity tolerance during both runs of the study. The salinity tolerance of some of the germplasm sources was similar to that of the tall fescue and perennial ryegrass check entries. Results suggest that selection and hybridization among the better germplasm sources will potentially result in bluegrass cultivars with increased salinity tolerance. The results of this study will be submitted for publication in a refereed journal in the coming months.

A Ph.D. graduate student, Mr. Shyam Shridhar, is currently conducting the gene expression work, specifically to identify candidate genes turned on during. This process involves imposing salt stress on salt-tolerant and salt-sensitive Kentucky bluegrass accessions. These accessions were identified in the screening procedure described above. RNA, the results of gene expression, was extracted from roots and shoots, purified, and subjected to suppression-subtractive hybridization (SSH) to detect differentially expressed sequences of DNA.

This procedure will allow us to identify genes expressed at a higher level in the salt-tolerant germplasm shoots and roots than sensitive germplasm shoots and roots. Currently the SSH procedure is completed, and the differentially-expressed genes are being detected and sequenced. In the coming months, we will be comparing the expressed gene sequences to a publicly available plant sequence database to assign possible gene function.

Summary Points

- We have observed significant variation in salt tolerance among the National Plant Germplasm accessions.
- The most salt-tolerant accessions exceeded the tolerance of Kentucky bluegrass check varieties and approached or exceeded the tolerance of perennial ryegrass and tall fescue check varieties.
- These encouraging results will result in the evaluation of a wider selection of *Poa pratensis* and *Poa spp.* germplasm.
- Genes expressed at higher levels in salt-tolerant germplasm will be identified and considered for future DNA markers.